Frankly Speaking

Motorways For Victory Era

TRANSPORTATION trends of the past *TWENTY* years have been checked, halted and in the case of local mass transit, completely reversed by the happenings of the past *TEN* months. Public transit had for years been facing a declining demand while the automobile had been enjoying a spiraling ascendancy based on a rather extravagant economy.

The average highway user has been made aware of the vulnerability of the automobile to total warfare by the cessation of automobile manufacturing. He has seen the speed of his motor vehicle reduced by Presidential Edict and his freedom to come and go by auto drastically curtailed by critical shortages of gasoline, tires and essential parts and services.

The war's effects have also been reflected in a recentralizing movement within metropolitan areas formerly experiencing the process of decentralization, depopulating centers, depreciating and destroying property returns and depositing a decaying growth around the civic heart.

But out of the conflict of total war should come public realization that mobility is the primary modern factor in urban development and that the urban areal pattern contracts and expands as the emphasis in mode of travel is shifted from or rests upon an automotive base.

The war has not changed transportation fundamentals. It has, in fact, brought them out in bold relief.

It is just as true today as it was immediately preceding the war and will be in the post-war period that each metropolitan area should have a system of motorways combined with parking and freight terminals interrelated with all other means of local transport and made part of a logical *Master Plan* for functional urban development.

Most of our highway traffic is destined for urban areas and the majority of motor trips are of a short-haul nature.

It is wasteful of public funds to spend for horse and buggy street construction when it would be good business practice to invest these moneys in motorways which would promote the public safety, convenience and prosperity.

Motor vehicular taxes, after deducting for emergency traffic needs, should be used for the preparation of plans for post-war motorway projects to be built where traffic demands are greatest.

Leslie Williams

Editor, Traffic Engineering

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WIDENING TRAFFIC ENGINEERING HORIZONS RESULTING FROM THE WAR

By BURTON W. MARSH

WAR is an abominable institution! Nevertheless it produces highly valuable by-products. War creates tremendous pressures—unequalled driving forces for getting many kinds of things, often "impossible" things, done very quickly. Almost unbelievable miracles of achievement take place.

A few examples of war-pressured-achievement affecting transportation generally as expressed by Dr. Charles M. A. Stine, Vice-President, E. I. du-Pont de Nemours and Company are set forth below:

1. *Rubber.* More than a century was consumed in bringing the crude rubber production of the world up to a million tons yearly. The United States alone is now undertaking to accomplish almost as mighty a feat in less than two years, by the production of synthetic rubbers to fill our needs.

2. *Aluminum.* By the end of 1943 our production of aluminum will be at a rate almost seven times that attained in 1939 after 50 years of intensive development.

3. *Magnesium.* Magnesium is about 60 per cent as heavy as aluminum and about 1/5 the weight of steel. In 1915 it sold for $5.00 per pound and until a few years ago was a curiosity in structural use. Today, it sells at about 22½ cents a pound, and we will by the end of 1943 be producing from brine, sea water and other sources about 100 times the amount produced in 1939. After the war, this nation's capacity for producing this lightest of all structural metals will be more than DOUBLE our aluminum output of 1939. Already *almost half a ton of magnesium is going into every American fighting plane.*

Think what effects these light-metal developments are bound to have on post-war cars and planes.

4. *New High-Tensile Strength Steel Alloys.* Nor is steel going to be superceded easily—steel is challenging these light metals. New steel alloys are bidding for expanding uses in aviation and wherever lightness and strength are requisites. These new alloys weigh three times as much as aluminum and five times as much as magnesium but their tensile strength approximates 190,000 pounds per square inch. This high strength permits weight to be shed by reducing bulk and eliminating needless supports.

5. *Petroleum.* Our liquid gold — petroleum — is rapidly becoming an eighth wonder of the world through the ingenuity of our chemists under war's pressures. It is already a major base for synthetic rubbers and scores of things never dreamed of as involving petroleum only a few months ago!

Some years ago it was believed that the ultimate in motor fuel would be produced when the power and anti-knock qualities of pure *iso-octane* were achieved—and iso-octane with 100 octane rating became a major standard in evaluating gasoline.

But ALREADY under war's pressure motor fuels are available which well exceed the 100 octane rating and deliver as much as 50 per cent more power than 100 octane fuel. So the petroleum chemist now sees all existing motors as due to be OUT-OF-DATE after the war — or sooner! Think what that will mean to highway and air transport!

6. *Other New Products.* Dr. Stine states that we will have glass that is "unbreakable," glass that will float, wood that won't burn, laminations of

plastics and wood that will compete with the structural metals, machinery bearings which contain no metal.

7. *Post-War Motor Vehicles.* Fuels, metals and plastics coupled with new "know how" resulting from urgent needs to meet emergency problems of warfare on deserts, in Arctic regions and under other most difficult conditions, are going to mean tremendous changes in post-war motor vehicles.

And let's remember that the motor vehicle manufacturers will with much new knowledge, be in many ways "starting from scratch" to build a new motor vehicle industry!

Car weight will be greatly reduced. Power output per cubic inch of piston displacement may double or treble what we now have. Fuels may yield 50 miles per gallon. Sealed cooling systems, proved on large scale by aviation, may end the nuisance of constantly checking radiator water. Tires which will not only equal but will surpass the best of today's may be reasonably expected. There will be scores of new mechanical inventions and improvements—now being hammered out with the highly stimulated best ingenuities of men's minds on the hard anvil of war's necessities. Many of these changes plus the popularity of smaller cars with fewer luxury items should mean low-priced cars.

8. *Post-War Aviation.* Airplane developments are occurring so fast that often before a new design is in production it is no longer "up-to-the-minute." Enormous airplane plant capacities are being built up for mass production. Tens of thousands of young persons are being trained as pilots. Air travel is "getting into the blood" of our people.

After the war, these developments can mean but one thing—both public and private aviation will mushroom almost unbelievably. Small, moderately priced, almost fool-proof, durable planes will assuredly come. Insufficiency of airports, one of the major handicaps to large private ownership of planes, is being reduced in several ways. The war is bringing large increases in numbers of at least emergency fields. The first "flight strip" as a feature of a highway is completed. Developments for cutting down space requirements for take-off and landing are being made — including the autogiro and the heliocopter.

Post-War Air and Highway Transportation. Air travel can be expected to supercede much of our pre-war long-distance motor vehicle and train trips where time-saving is important and cost is not too much a factor.

There are those who say that because of the growth of aviation, present increased use of mass transportation in cities, and other changes in transportation habits, motor vehicle transportation will never rise again to vehicle-mileages of pre-rubber-restriction days. However, present conditions are proving how closely the American economy is tied to highway transportation. Much of our highway transportation is essential—or highly important to our way of life. And while the American people willingly accept necessary restrictions to help win the war and to tide us over this "no-new-rubber" period, highway transportation will "bounce back" mighty fast as soon as restrictions are removed — though with some important changes. Remember, long trips (which will no doubt shift much to the air) constitute but a very small percentage of our motor vehicle mileage. The average length of motor vehicle trip has been about 15 miles.

For most persons, it would take some minutes to get to the place where their air trip would start. Often some change of apparel would then be made if a private aircraft were to be used. In such case, it would also take several minutes for inspections and engine warm-up before a flight started.

During such time intervals, much of any short trip could be completed by automobile. Planes will not supercede cars for short trips! So folks will still want to have a car — despite heavy taxes. On the other hand, some kind of aircraft may often supercede the second or third car in a family.

The above is presented because of many comments about air transport largely superceding highway transport. The proper viewpoint is that the two forms of transport will mainly complement each other, with improved overall transport results. Thus, freight of high value, small bulk and low weight will be increasingly carried by air especially if quick delivery is important. The effects on highway transport will be beneficial.

In the future, highway transport people should work very closely with those dealing with air transport especially as regards terminals, flight strips and most efficient correlation of the two forms of transport. It certainly behooves the traffic engineer to become air-transport-minded! Those who prepare themselves will find many opportunities for service.

Other Kinds of Valuable By-Products of War

Presented above are some marvelous developments in materials and material things which will broaden man's horizons in many ways. Even more important are the beneficial effects of war on our thinking, our attitudes, our habits and customs.

War forces us out of ruts—it at least temporarily rouses us from many inertias. War forces us to do many things, to face new problems, to accept many changes and hardships, to cooperate more effectively. War causes us to give more attention to our duties and responsibilities and to give less emphasis to privileges and luxuries. It causes us to be more serious and intense in our work.

Yes, war with its pressures and its powerful stimuli, tremendously accelerates scientific progress and jarringly affects men's minds.

Effects of the War on the Traffic Engineer

Let us now consider how the war and its many changes affect the traffic engineer.

The war has already broadened the field of activity—yes, even the concept of traffic engineering. In so doing the war has already greatly widened the horizon for the alert and progressive traffic engineer.

This war has become very largely a war of transportation. This statement applies to all kinds of transportation. Fortunately many traffic engineers are developing a broader understanding of the importance of other forms of transportation and the relationships between those other forms and his field of highway transportation. Thus numerous traffic engineers with the armed forces as well as many serving in civilian capacities are giving much attention to problems involving railroad, air and water transport and *to effective integration of all forms of transportation* for maximum progress toward winning the war.

In the field of highway transportation, many traffic engineers are giving greatly increased attention to *mass transportation*—to its proper place in highway transportation, to aiding in the solution of the many intricate problems of mass transportation such as efficient scheduling, methods of speeding up service, routing, stops and terminals. There are good reasons to believe that in the post war period, mass transportation will continue to occupy a more important place in urban traffic than was true before the war.

The traffic engineer is giving more attention to *economics of highway transportation*—how to get the maximum of essential transportation with a minimum of transportation units—

where and when the various types of equipment should be used. Many other economic matters warrant increased attention by traffic engineers. The following example illustrates the importance of economic study and analysis: after a particularly dramatic fatal accident at a railroad grade crossing, a large city installed a grade separation at a cost of $700,000. Yet much larger casualty tolls were being produced because of railroad grade crossing signal installations in the centers of highways in the same city. It was estimated that all such "center signals" could be replaced by roadside signal installations for about $35,000!

War conditions are bringing to traffic engineers valuable experience in *administration, coordination of related activities* and *public relations*. Progressive traffic engineers are having important parts in administering war emergency highway transportation activities, in coordinating activities of new groups including labor, war plant managements, Federal war agencies and other groups. Highly important, too, is the pressing need for selling war emergency programs to many different kinds of groups—an activity in which there has always existed weakness on the part of many technicians, including traffic engineers.

Important problems of *planning* are through the pressures of war being faced by traffic engineers. One example is presented in the splendid paper by Eugene Barton entitled "Automobile Movement and Parking at War Plants," which shows how a traffic engineer, cooperating with other specialists, has been dealing broadly with various critically important planning problems relating to highway transport, for a large war plant.

The War is Greatly Advancing a Profession

Obviously, the traffic engineer cannot become a qualified expert in all phases of transportation! His proper field will continue to be that of a HIGHWAY TRANSPORT "OPERATIONS" ENGINEER, a field the importance of which has long been recognized by railroads and which is rapidly "coming into its own" in highway transportation. The proper field of the operations engineer includes all matters having to do with *use* of the highway transportation system, including relationships with other forms of transportation. Subjects properly within his field though not in many cases his exclusive field are (1) geometric highway design, (2) road surface characteristics affecting traffic, (3) terminals—their location, design and operation, (4) methods of securing efficient highway transportation (including accident prevention and public education), (5) vehicle performance, (6) traffic capacity, speed, composition and other characteristics of the traffic stream, (7) driver characteristics and driver behavior, (8) methods of supervision and control of both vehicular and pedestrian traffic, (9) the use of relationships of metropolitan highway transportation systems to other transportation facilities and to city planning, and (10) highway transport economics.

There was a very real danger of the traffic engineer becoming "pegged" as a useful, expert artisan in the admittedly important but all-too-narrow field of signs, signals, markings, collision diagrams, corner cutbacks and traffic counts. This "pegging" would have been the fault of the traffic engineers themselves, for all too many were satisfied to limit their activities to these too limited fields. Others, however, saw that their training and experience *should* mean a vastly broader field of public service. But lack of trained engineer-assistants, very inadequate financial resources and terrific unending pressures to get important but *detailed* jobs done, left little time

for those broader and fundamentally much more important matters which should engage most of the traffic engineer's thought and attention.

Thus many a traffic engineer struggled to convince property owners and the city council that certain parking regulations should be adopted when he should have directed his talents to overall planning of parking and terminal facilities (many of which he knew should be off-street), to attaining and maintaining proper balance between private passenger car travel to the central district and mass transportation, to effective main thoroughfare and routing plans. For such activities would do MUCH more to provide efficient operation of the highway transportation system than the *detailed* jobs he could not escape doing!

The same difficulties often kept many a traffic engineer from pooling his specialized *operations* knowledge and skill with the city planners and highway designers. The traffic engineer could *often* prevent design mistakes which *ironically* he inherits and has to remedy as best he can AFTER THE HIGHWAY FACILITIES, TERMINALS, AVIATION FIELDS ARE BUILT! Unfortunately, though progress has been highly encouraging, many highway engineers and city planners are still not sufficiently operations-minded.

One illustration — a top-ranking traffic engineer, visiting one of our largest cities, listened with keen interest to a splendid paper FROM THE STRUCTURAL VIEWPOINT on the building of a highly important bridge. Afterward, he asked the author of the paper how much attention had been given to traffic—to OPERATIONS—in the design of the bridge. "Oh," replied the designer with surprise in his manner at the question, "we leave that to the police to handle when the bridge is built."

The state traffic engineer also has been faced with the same difficulty of being buried in details resulting from an all too narrow concept of what the OPERATIONS ENGINEER has to contribute to highway transportation. A major need today is to get *much* more of operations engineering into highway design! This need is especially great in the development of modern metropolitan highway transportation systems—to which *much* greater attention of state highway departments must now be given. There is also need for a much more active collaboration between highway planning units and traffic or operations engineers.

THE WAR HAS BROUGHT CHANGES IN ACTIVITIES OF THE TRAFFIC ENGINEER WHICH WILL, I BELIEVE, MEAN THAT THE PROFESSION OF TRAFFIC ENGINEERING—OR AS IT MIGHT BETTER BE CALLED—"OPERATIONS" OR "TRANSPORT ENGINEERING" WILL RISE TO A FAR MORE IMPORTANT POSITION IN TRANSPORTATION!

A desirable long-range objective for the Institute would be broadening it into an INSTITUTE OF TRANSPORT ENGINEERS. Some steps in the right direction would seem to be: (a) rephrasing the Institute objectives to make clear an intended broader connotation, (b) bringing into Institute meetings and publications, discussions of broader transportation subjects, (c) opening membership to other transport engineers than those meeting our presently too limited connotation.

Objectives

The time seems appropriate for reconsidering what goals the traffic or operations engineer should set for himself. This subject warrants serious consideration by leaders in this Institute. The following is offered as a partial basis for such consideration:

The traffic engineer should seek to become so highly regarded for demonstrated knowledge, skill, ability and breadth of viewpoint that he will be:

1. A full partner in the planning team. His specialized knowledge and

skills should be actively utilized not only in planning major highway and freeway networks but also in the planning of parking and terminal facilities, the highway operations phases of interchanges involving other forms of transportation, highway transportation phases of housing development and of industrial plant operation.

2. An official whose approval must be secured on operations phases of plans for all city developments affecting highway transportation. Already in a number of places the traffic engineer must indicate approval in writing on all plans for bridges and their approaches, highways, etc.

A traffic engineer in a large city recently demonstrated the potential value of requiring such approval. He showed a leading architect how following one basic principle of traffic engineering in locating the parking lots at a large war plant would have saved $500,000 in original investment, and $116,000 per year in operating costs. *Yet the architect had never heard of the profession of traffic engineering.*

3. The traffic administrator directly responsible for highway transportation *operations* in his state, county or city — and without petty limitations now often imposed through laws, ordinances or departmental regulations. Among broadened responsibilities is that of searching for the non-obvious, more remote, fundamental causes of operations problems.

4. A leader in the *coordination* of all forms of transportation—and in the future this must include greatly increased attention to aviation.

5. A major advisor on *legislation* relating to highway transportation operations—along with the police on enforcement phases of such legislation.

6. A recognized source of facts and other materials for public education on operations phases of highway transportation—including the need for various measures, reasons why various steps are taken, how the public is expected to cooperate, etc.

7. A major advisor on economic questions related to highway transportation operations.

A number of traffic engineers already have achieved all or most of these goals.

How Is The Interested Individual Traffic Engineer To Advance To Such Larger Professional Stature?

This question—too broad for comprehensive treatment here — warrants serious consideration of Institute leaders. However, the following homely points include some of the broad essentials. For most of these points as for other valuable suggestions the writer is indebted to Professor Roger L. Morrison:

1. By realizing: (a) the need for broadening one's horizon and (b) the enlarged opportunities which will result thereby.

2. By continual hard study, including study of important related subjects beyond the scope of daily tasks. Some years ago, a graduate asked Prof. Morrison why for years he hadn't advanced in position or responsibilities. Frank discussion revealed the basic fact that the inquiring graduate was not keeping up with latest technical developments, that he wasn't studying beyond his daily job, that he was not active in any professional society —in a phrase, that he had stopped developing professionally. The grateful graduate *woke up*—and now he's going places!

3. By accepting additional responsibilities and opportunities to do *new things*—yes, including things which at first SEEM beyond one's capabilities.

4. By freeing one's mind of wrongly self-imposed limitations. As one traffic engineering pioneer said "You don't know what you can do until

you HAVE to do things"—and he then illustrated his point by showing a list of present duties which was staggering in scope and responsibility.

Though vitally important, the above four points are general in nature. A program of more specific guidance should be formulated by Institute leaders of broad experience. This matter deserves prompt attention. For there are challenging days ahead. There seems little doubt but that very large programs for development of modern highway transportation facilities, particularly for metropolitan areas, will constitute one of the major public works methods of cushioning the post war readjustment period. Such programs will be essential for avoiding catastrophic unemployment as service men return to civilian life and as war plants convert to civilian work, often requiring much less manpower. Planning for such projects should be under way *now*. Yes, now, when there are serious deficiencies in experienced specialists fitted for the gigantic task with its many new problems and its great difficulties. This means that golden, once-in-a-lifetime opportunities confront those traffic engineers who have the vision, the energy and the determination to grasp them.

But many such men will want to prepare themselves further. In a few places where there are a number of interested traffic engineers and where college faculty members are qualified and interested, colleges could help by offering special night courses in city planning, transportation, air transport, transportation economics, etc. Some traffic engineers will have to study by themselves or in groups. In a number of places, group meetings could be arranged for lectures by competent authorities and for stimulating discussions. The Institute can help by recommending a study program with specific recommendations as to books, reports, papers, plans to be studied. It might devise a personal check-list as a basis for determining in what subjects study is most needed. Suggestions as to an order in which subjects and materials might well be studied, might conceivably be given to individual traffic engineers, based on their check-lists and on other pertinent information made available to a group of I.T.E. training advisors — perhaps the new Institute Training Committee. These are days of intensive specialized training courses of many sorts —why not "in service" courses for interested traffic engineers? A well conceived program along these lines might interest one or more of several agencies which are in position to provide grants or other valuable assistance.

Opportunity is knocking. The need is great for specialists who not only have thorough knowledge of highway transport operations but who are also well informed on related subjects. Time is short. There are satisfying rewards for those who meet the challenge.

An original paper presented by Burton W. Marsh (Mem. I.T.E.), Director, Traffic Engineering and Safety Department, American Automobile Association, Washington, D. C., at the 13th Annual Meeting of the Institute of Traffic Engineers, Chicago, October, 1942.

TRAFFIC MOVEMENT AND PARKING AT WAR PLANTS

By EUGENE A. BARTON

PRODUCTION of war materials has assumed greater importance in the present world conflict than in any other war in the history of the world. This is a machine war and the side with the most machines is most likely to win enough battles to bring victory. America is moving with increasing momentum toward that victory. Our armies are fighting in distant parts of the world, and here in America a tremendously expanded industrial populace is called upon to supply our Army and Navy with the finest fighting equipment in the world.

Pivotal point of this industrial effort is the aircraft industry, to a large unit of which it has been my good fortune to contribute the fruit of a training common to you and me. The expansion of this great industry has been enormous and rapid—more of an explosion than an expansion.

Great problems have had to be solved—the building of huge plants, the designing of outstanding airplanes, the tooling of those plants, and the evolution of mass production technique in order to meet the tremendous schedules necessary to win a war. In general two major factors have been involved in the aircraft effort. They are: *Manpower* and *Materials*.

The vast training program that has been necessary to handle the multiplicity of operation needed in the manufacture of planes has been a titanic effort. The more recent problem of training women to take the place of men has intensified the problem. The question of availability of materials, all the way from source through fabrication has been a Gordian knot for the industry.

But there has been one common denominator in both of these two major factors—adequate transportation, the transportation of manpower and the transportation of materials. This has thrown no small burden on the traffic engineering profession. Indeed, it has been one of the greatest problems that we have had to face.

This has been no gradual evolution. It is not at all the problem of the natural growth of traffic in cities and on state and county highways. Some of the greatest bottlenecks in production can be traced to traffic congestion immediately adjacent to and surrounding war manufacturing plants. In most cases enormously heavy traffic has been suddenly imposed on streets and highways never intended to bear them. There are two distinct classes of war plants—urban and suburban, each presenting different causes of congestion.

Urban Manufacturing Plants: Manufacturing plants, whether large or small, can in most cases be classified alike. Small plants have grown on location to large-plant proportions very suddenly. On the other hand, large plants, because they are unable to increase greatly on location, have had to expand over a wide urban area by taking over warehouses, automobile showrooms and the like and converting them practically overnight into small-parts sub-assembly plants. This has thrown into the normal city traffic pattern considerable peak flow congestion and parking congestion well beyond the saturation point. Because of this congestion, the plants have lost many man-hours because of the tardiness of employees and a bottlenecking of important interplant transportation of raw materials, small parts, and sub-assemblies.

Typical of large and small war industrial cities are Baltimore and Hagerstown, Maryland, respectively. Both have had the problems I have just out-

lined. Part of the responsibility for the solution of the great problem in Baltimore has fallen upon me. A comprehensive study was conducted during November, 1941, and as traffic engineer of the Glenn L. Martin Company I cooperated in this study with the Maryland Public Service Commission, the Baltimore Association of Commerce, Representatives of Shipyards, Steel Corporations, and the Baltimore Traffic Engineer, Mr. Wally Braun. Out of this comprehensive study came specific recommendations to the operating committee—recommendations which we felt contributed greatly to the continued success of the war industry program in Baltimore. Our highlight recommendations were these:

1. Generous staggering of hours in all plants.
2. Establishment of car-pooling bureaus.
3. Designation of additional one-way streets.
4. Readjustment of Personnel (Residents in east to work in eastern part of the city, etc.)
5. Exchange of Personnel.
6. Establishment of bus routes and bus stops at non-congested corners.
7. Staggering of store hours.
8. Change of school periods.
9. Use of charter-type busses for employee transportation.

First of Baltimore's industries to stagger hours was the Glenn L. Martin Company. Its first major change was made in July 1941. So successful was this plan that many plants undertook studies of their own traffic and overall studies of nearby plants in order to correlate the entire traffic, and thus obtain maximum use of traffic arteries.

Many new one-way streets have greatly relieved peak flow and have considerably lessened the travelling time of employees to and from work. Again, following the lead of the Martin Company, car-pooling or ride-sharing bureaus have been established in many of the plants. Furthermore civic-minded people in Baltimore have established a similar plan which operates solely through house to house canvass and newspaper advertising. To a considerable degree employee readjustment and exchange has been carried out and has already borne fruit. Much is expected of this plan.

Establishment of specific supplementary bus routes using streets unused by existing public transportation has been a big step toward leveling peak traffic and in reducing accidents.

Staggering of store and school hours has also done its expected share.

Urban parking has been a constant sore spot, but it has succumbed in large measure to the treatment of traffic heads. In order to solve this problem we:

Urged and encouraged the use of public transportation facilities.

Designated specific parking lots and streets away from heavily used arteries and plant areas.

Designated off-street parking lots on the outskirts of the business area where employees gathered. The balance of the distance is being traveled via public transportation facilities.

Instituted ride-sharing — to reduce car volume.

Suburban Manufacturing Plants: Despite the fact that urban and suburban manufacturing plants are classified alike, the suburban factories have traffic problems which differ greatly from those in the city. In nearly all cases traffic converges upon one point —the plant. Generally speaking, roads leading to it are limited to one, two or three which have been built for far less traffic loads.

Traffic flow and parking at very small suburban plants offer only a minor problem. However, the parking areas must be located with due re-

gard to the source of the greatest number of vehicles. For example, if traffic approaches the plant from the east and west only, parking lots should be located on the east and west sides of the plant. This prevents cross traffic congestion, and allows for plant expansion to the north and south.

On the other hand, large plants really present a big problem. Under present circumstances, of course, we must forget that the traffic engineer might have alleviated the entire problem had he been forewarned of the expansion and planned in advance, but the emergency of war brings many unexpected developments and the traffic engineer thus finds himself injected suddenly into the accelerated beat of production. Large plants grow larger, and where a modest enterprise pursued its quiet ways yesterday, today we find a gargantuan industry. Nightmares of traffic snarls plague the orderly dreams of the engineer. Many years of hard work and of orderly procedure by city and county engineers all over the country have been nullified by the tidal wave of War Production and, as forementioned, war plants are the primary cause.

No industry has been called upon to expand more rapidly and to such enormous proportions as has the aircraft industry. Typical of the larger units which are attempting to bring air superiority to the American forces is The Glenn L. Martin Company, which is located in the suburbs of Baltimore approximately 12 miles from the city. Here, as in other large plants with heavy war contracts, the traffic engineer has had no opportunity to plan. He has been called in to attend the patient at the crisis and not at incipiency. I am not allowed to give actual figures of present employment, but I would like to mention that in early 1939 the Martin Company had but 3,500 employees and a modest plant layout, today it has a working population which is larger than the second largest city in Maryland, and the number of people dependent on Martin payrolls — workers and their families—is roughly equivalent to the population of such cities as Albany, N. Y., or Norfolk, Va. In 1939 alone the Company jumped from its 3,500 employees to 13,000 workers and there has been a tremendous upward trend in employment ever since.

What was serving this plant in the way of traffic arteries? Two 2-lane roads and these converged at a point about 500 yards from the plant entrance. Today traffic is astonishingly smooth, but it has not been so long since traffic lines backed up during shift changes for 2.3 miles on one road and as much as 3.1 miles on the other. Average travelling time to the plant after reaching the tail ends of the lines amounted to from 28 to 45 minutes. There were no auxiliary roads available for rerouting the traffic. The only obvious step, therefore, was to distintegrate the three work shifts into a series of 16 smaller groups. This plan was put into effect during the latter part of July, 1941.

The Company and the community then embarked upon an extensive program of physical improvement which ultimately contributed greatly to the solution. In the first place, a dual highway was built from Route #40 1.9 miles from the plant. Next a dual road was built around the plant as a perimeter highway for use of Company vehicles and as a by-pass for employee vehicles. An additional underpass was built under the Pennsylvania Railroad which parallels one of the two roads and crosses the other. This provided an underpass for each of the two routes of the dual highway.

Additional parking lots were provided. Today the Company has some 44 acres of parking lots.

A cloverleaf grade separation was

built at the merging point of the two highways leading to the plant.

Adequate traffic signs and markings, many of them reflectorized, were installed.

Even further staggering of larger work groups was effected, raising the number from 16 to 29.

Proper street lighting and flood lighting of parking lots was installed.

Pedestrian safe walkways were built and a complete rotary traffic plan embracing both the plants and the airport was worked out.

A pedestrian underpass was built at the Railroad to keep people from crossing tracks, and to prevent friction with wheeled traffic.

A considerable housing project was embarked upon with 2300 four and one-half pre-fabricated houses being built and in addition 1300 trailer units, 184 apartments, and approximately 25 large dormitory buildings were constructed. A considerable community was created, detracting somewhat from the heavy flow of traffic. All of this took place within a radius of 2½ miles of the plant.

It was imperative that the parking method be revised in accordance with the work shift schedule and with the rotary traffic plan. For example, one parking lot with a capacity of 3,200 vehicles was so laid out that as many as 13 work groups now park in it during each 24 hour period.

The Protection Department, a highly trained industrial police organization, is equal in size and scope of operations to the police departments of many cities of 250,000 to 300,000 population. Its members direct all traffic flow, parking, etc.

The most remarkable results of the rotary traffic plan and the concentrated efforts of highly trained plant traffic police can be summed up as follows:

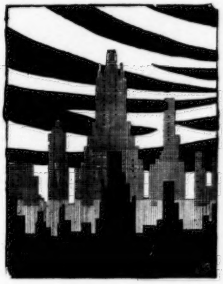
1. Traffic congestion reduced 95%
2. Motor vehicle accidents reduced 70%
3. Pedestrian accidents reduced 88% (After improvements of July, 1941, only 1 pedestrian was injured in a motor vehicle accident during a 15 month period)

In September of 1941 an earnest effort was made to fill up employees' cars as a means of moving more people without increasing the number of automobiles. A Ride Sharing Bureau was established, and it is notable that the number of riders per car increased from 1.9 in July, 1941 to 4.6 in October, 1942. This is a record increase among the industries of the country according to Joseph B. Eastman, Coordinator of Defense Transportation.

Another contributory study was that of residences of employees. This was conducted at the start of 1942, and out of it developed a highly successful pattern of auxiliary bus operations. By glancing at a spot map it was possible to know the transportation of people within the entire Baltimore metropolitan area, and nearby towns. It was possible thus to readjust employees by location where feasible.

I strongly feel that much has been achieved under extraordinarily difficult circumstances at this enormous unit of the aircraft industry. The elements of the problems were knotty indeed, and the solution could not have been found without the full cooperation of a sympathetic management.

An original paper presented by Eugene A. Barton (Assoc. I.T.E.), Transport Officer, Third Civilian Defense Region and formerly Traffic Engineer, Glenn L. Martin Company, Baltimore, Maryland, at the Thirteenth Annual Meeting of the Institute of Traffic Engineers, Chicago, October 1942.



Stop, Look and Listen

IN APPRECIATION

The Institute of Traffic Engineers, in a unanimous resolution passed at its Thirteenth Annual Meeting, extends its appreciation to the Rhode Island School of Design, Mr. Alcott, Dean of the Men and Head of the Graphic Arts Department, and the students who participated in the preparation of the original designs for the cover of its official publication of TRAFFIC ENGINEERING.

Special mention is made here to Miss Marken Scholes for her excellent composition expressing the importance vehicular traffic plays in our national life and the place of the Institute of Traffic Engineers in traffic regulation and administration.

DESIGN OF HIGHWAY GUARDS

Detailed designs for highway guards under wartime limitations on critical materials are presented in Bulletin No. 2 of a Series on Wartime Road Problems prepared by the Highway Research Board.

DURATION STANDARDS

All 48 states now have uniform size and weight standards governing motor vehicles. The new regulations follow closely the recommendations made by the Public Roads Administration. They include a permissible height of 12½ feet; width 96 inches; length of a single vehicle 35 feet; length of a combination vehicle 45 feet; weight per inch of width of tire 600 pounds; weight on one axle 18,000 pounds; weight on two axles 30,000 pounds; weight on three axles 40,000 pounds.

REIMBURSEMENTS FOR HIGHWAY PURPOSES (?)

Senators Russell of Georgia and Maybank of North Carolina have entered a bill in the Senate to reimburse states for losses from gasoline tax revenues resulting from gasoline rationing. The measure would require the Secretary of the Treasury to reimburse the states at the end of each calendar quarter and the states to spend this money in the manner authorized by state laws for the expenditure of gasoline tax revenue.

LOOKING FORWARD

American Society of Civil Engineers—Winter meeting, New York City, Jan. 19-22.

American Institute of Planners—Annual meeting, Pennsylvania Hotel, New York City, Jan. 22-23.

WARTIME TRAFFIC PROGRAM

TWENTY-FOUR national organizations have joined with the Institute of Traffic Engineers in sponsoring a statement on Wartime Highway Traffic. These organizations recognize that "Our highway transportation system must be stripped of all non-essentials and dedicated to the winning of the war, that essential highway transportation is a vital part of our Nation's war effort; and therefore pledge their wholehearted support to the conservation and efficient utilization of these facilities."

Objectives of the program are threefold—conservation of critical stocks of vehicles, tires and roadways; conservation of man-hours and manpower through a reduction of accidents; and the most efficient use of roads and vehicles for essential transportation. It is felt by the sponsoring groups that this extensive plan can only be carried out if official agencies, federal, state and local, are coordinated, and if the cooperation of non-governmental organizations in mobilizing public participation and support is obtained.

The recommended scheme for gaining these objectives fall into the six following categories:

1. "*Engineering*" for making roads open and safe and for gaining maximum efficiency of mass transportation through staggered hours, re-routing, etc.
2. "*Police Control*" for preventing needless waste of materials through speeding, overloading and for enforcing the law in restricted areas or during blackouts and other war hazards.
3. "*Legislative Action*" for creating a state traffic coordinating body with sufficient authority for appropriating funds for essential war traffic agencies.
4. "*Motor Vehicle Administration*" for collecting and analyzing accident reports and for keeping drivers and their equipment under careful check.
5. "*Training*" for offering all vehicle drivers an essential background to meet emergency needs.
6. "*Public Participation*" for eliminating non-essential vehicle use for encouraging group riding and caring for the vehicle's equipment.

Rubber Director, William M. Jeffers, recognizing the importance and necessity for following such a plan states in his letter printed in the Wartime Highway Traffic Program that "There is no possibility in the period ahead of returning to unlimited use of vital motor transportation facilities." Joseph B. Eastman, Transportation Director of O.D.T., adds, "The important job for every car and truck owner . . . is to conserve his own transportation facilities to the utmost in this emergency."

The importance of installing a scheme similar to that presented above cannot be stressed too much, for President Franklin D. Roosevelt informs us, "The demands of war on our national resources make it imperative that unessential travel be eliminated for the duration. Traffic necessary for war purposes must be made as efficient and as safe as it is possible to make it. My appeal to you is for prompt and vigilant cooperation."

Digest of a Wartime Highway Traffic Program distributed by the Automotive Safety Foundation, Tower Building, Washington, D.C.

GLASS-BEADED PAINT FOR BLACKOUT TRAFFIC CONTROL

By ROBERT A. MITCHELL

FIVE HUNDRED miles of Philadelphia streets are being marked to provide more efficient control of traffic during blackouts. As a result of many months of experiments and testing, glass-beaded paint and glass-beaded cloth is being used as the only satisfactory material under low intensity light conditions.

Good pavement markings are far superior to elevated signs, especially at the edge of the roadway, for the guidance of blackout drivers because of the necessary low direction and low intensity of blackout driving lamps. Objects higher than 30 in. above the roadway are difficult to see especially if the roadside marker must be 50 ft. to 60 ft. in front of the vehicle for reasonable visibility. Self-illuminated signs naturally are visible at greater distances.

Quality of material, care in selecting the type of marking and method of application were found to be particularly important.

Power-driven spraying machines equipped with special containers for properly distributing the glass beads in the paint line laid eight miles of 6-in. wide center-line composed of alternate 25-ft. stripes and 25-ft. spaces in an average day of eight hours. Crosswalk and curb markings naturally cannot be applied as rapidly. The above time includes going from shop to field location and back again, and also includes the time required for cleaning of the machine after each day's work. Daily cleaning of the machines is most important because any dried paint blocking the spraying apparatus causes an uneven surface and prevents the satisfactory distribution of the glass beads.

Glass-beaded paint costs about two and one-half times as much as ordinary traffic paint. If properly applied, however, it will remain perfectly visible on the highway from four to five times as long. Thus in the final analysis it is really cheaper not only from the standpoint of the purchase price, but also in reducing maintenance costs. The paint installed on the experimental course in February, 1942 is still effective. Center lines put on Broad Street during the first week of June show practically no wear today.

The best results are obtained on smooth pavement surfaces but the paint manufacturers are working closely with the city to find some way to get the paint to adhere better to the granite block pavement.

Experiments have shown that a glass-beaded cloth gives the best results on vertical surfaces, being not only applied easily and quickly, but it is not injurious to trees. It will be used in 4-in. wide strips to mark curbs, poles, posts, trees, and any other obstruction in the road or object alongside the street that would serve to guide motorists and keep them from driving off the road under blackout conditions. Strips on posts, trees, etc., are installed to a height of 2.5 ft. above the roadway, and only on the side from which traffic approaches. This gives an effective coverage with a minimum amount of material.

Practically all of the main highways in Philadelphia have been marked with center lines and cross walks and those who have driven through the streets during a practice blackout report that these markings have been of considerable aid in moving about.

Condensed from an article appearing in ENGINEERING NEWS RECORD, Nov. 19, 1942, by Robert A. Mitchell (Mem. I.T.E.), Chief, Bureau of Traffic Engineering, Philadelphia, Pa.

COLLEGE-LEVEL SAFETY TRAINING

By J. L. YELLOT

INDUSTRIAL safety is a subject, the importance of which is not generally recognized in engineering colleges. This condition is being changed for the better by the tremendous increase in government-sponsored, college-level, technical training for war industry, which has brought about the initiation of safety engineering programs in at least a hundred colleges throughout the nation last year.

During the winter of 1940, the United States Office of Education began financing (through Federal funds) short, intensive courses in fields in which there was a shortage of technical skills, which training was conducted by the accredited colleges of the country. Hundreds of thousands of students have been trained in courses ranging from elementary drafting to the most advanced form of ultra-high techniques.

During the summer of 1941, the newly created National Committee for the Conservation of Manpower in War Industry made arrangements with the Office of Education to incorporate safety training in courses.

The success of the program in Chicago, undertaken by the Illinois Institute of Technology, was due largely to the cooperation given by the Greater Chicago Safety Council and the National Safety Council who provided staff assistance, as well as materials. Sixty instructors were secured from the ranks of the ASSE—Engineering Section, National Safety Council, mostly safety men from industry or insurance companies, few of whom had any previous teaching experience. These men met once a week for seven weeks, conferring on the instructional material and holding practice lectures.

A group of 600 students were enrolled late in January, 1942, after letters had been sent to most of the industrial personnel men in the city, requesting them to use the personal-contact method to interest prospective students. A second group of 500 began training in February, making a total group of 1,100.

The standard 96-hour course was given with two 3-hour evening sessions each week for sixteen weeks, each instructor conducting his own class throughout the entire program. True-false quizzes were used each evening, covering the material which had been assigned for study, which usually stimulated vigorous discussions. Visual aids were used widely, and the excellent sound-film strips produced by the National Safety Council were shown regularly.

A high light of the school was the term paper required of each student, which consisted of a suggested safety program for his own plant, and in at least five plants, where there was previously no safety organization, student's recommendations have been adopted.

The purpose of this course was most definitely not the creation of a large number of fully-trained safety engineers, and this was made clear at the outset. Nevertheless, a surprisingly large number of men have received jobs as safety directors as a direct result of the course.

Of the 1,100 men and women who enrolled in the program, some 780 were graduated, and these students are now working in 340 plants in the Chicago area. The conditions in these plants, according to the insurance and factory inspectors, are improving.

Condensed from an article by J. I. Yellott, Chairman, War Training Committee, Illinois Institute of Technology, published in *National Safety News*, September, 1942.